

CLAIMS

1. A method of producing a framed-metal-matrix-composite-sheet from a powder mixture, said method comprising:
 - a. producing said powder mixture by mixing a matrix metal powder and at least one reinforcement material;
 - 5 b. loading said powder mixture into a metal frame to form a framed-mixture;
 - c. consolidating said framed-mixture to form a framed-billet; and
 - d. rolling said framed-billet to said framed-metal-matrix-composite-sheet.
2. The method in accordance with Claim 1, wherein said matrix metal powder is selected from the group consisting of aluminum, magnesium, copper, iron, zinc, nickel, cobalt, titanium, and alloys thereof.
3. The method in accordance with Claim 1, wherein said matrix metal powder has an average particle size less than about 100 microns.
4. The method in accordance with Claim 1, wherein said reinforcement material is selected from the group consisting of silicon carbide, silicon nitride, titanium nitride, titanium carbide, titanium silicide, molybdenum silicide, nickel aluminate, boron carbide, aluminum nitride, aluminum oxide, magnesium oxide, gadolinium oxide, ceramic materials and mixtures thereof.
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5. The method in accordance with Claim 1, wherein said reinforcement material is selected from the group of aluminum, boron, cobalt, copper, iron, magnesium, nickel, silicon, titanium, zinc, alloys and mixtures thereof.

6. The method in accordance with Claim 1, wherein said reinforcement material has the physical shape of particulate, whiskers fibers and mixtures having average diameter less than about 100 microns.
7. The method in accordance with Claim 1, wherein said powder mixture comprises between about 55 vol.% and about 95 vol.% of said matrix metal and between about 5 vol.% and about 45 vol.% of said reinforcement material.
8. The method in accordance with Claim 1, wherein said matrix metal powder comprises a pre-alloyed powder.
9. The method in accordance with Claim 1, wherein said matrix metal powder comprises a mixture of at least one elemental powder.
10. The method in accordance with Claim 1, wherein said metal frame comprises a perimeter frame.
11. The method in accordance with Claim 1, wherein said metal frame comprises a two-sided frame.
12. The method in accordance with Claim 1, wherein said metal frame comprises an encapsulating box frame.
13. The method in accordance with Claim 1, wherein said step "c" further comprises the steps of:
 - a. pressing said framed-mixture at room temperature to form a framed-compact having a density of between about 50% and about 95% of

theoretical density;

- b. heating said framed-compact in a controlled environment at a degassing temperature range from about 230°C (450 °F) to less than the lowest eutectic melt temperature of elemental powder in said matrix metal powder;
- c. degassing said framed-compact at said degassing temperature range for at least about one-half a hour to form a degassed-framed-compact;
- d. heating said degassed-framed-compact to a consolidation temperature; and
- e. hot pressing said preheated-degassed-framed-compact in said controlled environment to form a framed-billet having a density between about 98% and about 100% of theoretical density.

- 14. The method in accordance with Claim 13, wherein said controlled environment is a vacuum environment.
- 15. The method in accordance with Claim 13, wherein said controlled environment is an inert-gas environment.
- 16. The method in accordance with Claim 13, wherein said controlled environment is an air environment.
- 17. The method in accordance with Claim 13, wherein said consolidation temperature is the highest eutectic melt temperature of elemental powder in said matrix metal powder having at least one elemental metal having lower melt temperature than melt temperature of a basic elemental metal powder in said matrix metal powder.

18. The method in accordance with Claim 13, wherein said consolidation temperature for said matrix metal powder containing only said basic elemental metal powder is the temperature being below melt temperature of said basic elemental metal powder.
19. The method in accordance with Claim 1, wherein said step "c" further comprises the steps of:
- a. pressing said framed-mixture at room temperature to form a framed-compact having a density of between about 85% and about 95% of theoretical density;
 - b. heating said condensed-framed-compact in said controlled environment at said degassing temperature range;
 - c. degassing said framed-compact at said degassing temperature range for at least about one-half hour to form a degassed-framed-compact; and
 - d. heating said degassed-framed-compact to a sintering temperature being the highest eutectic melt temperature of elemental powder in said matrix metal powder having at least one elemental metal having lower melt temperature than melt temperature of said basic element metal powder in said matrix metal powder to form said framed-billet having a density of between about 85% and about 95% of theoretical density.
20. The method in accordance with Claim 1, wherein said step "c" further comprises the steps of:
- a. pressing said framed-mixture at room temperature to form said framed-compact having a density between about 60% to about 95% of theoretical density;

- b. heating said framed-compact in a gas environment to said consolidation temperature to form a preheated-framed-compact; and
 - c. hot pressing said preheated-framed-compact in said gas environment to form said framed-billet having a density of between about 98 and about 100% of theoretical density.
21. The method in accordance with Claim 20, wherein said gas environment is an inert-gas environment.
22. The method in accordance with Claim 20, wherein said gas environment is an air environment.